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REPORT 1870 - 1873

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Report of Commissioners of Fisheries of the State of California for the Years 1870 and 1871

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REPORT OF THE COMMISSIONERS OF FISHERIES OF THE STATE OF CALIFORNIA FOR THE YEARS 1870 AND 1871

REPORT

To His Excellency, H. H. Haight, Governor of California:

The Commissioners of Fisheries for the State of California, appointed under an act of the Legislature, entitled "An Act to provide for the restoration and preservation of fish in the waters of this State," approved April second, eighteen hundred and seventy, respectfully submit their first biennial report.

REPORT

California has a seacoast extending through ten degrees of latitude, and a shore line of nearly eight hundred miles. The Coast Range of mountains, which adjoins the coast line for the greater part of this distance, creates by its western watershed nearly one hundred streams and rivers emptying into the Pacific Ocean. These streams and rivers vary from twenty to sixty miles in length. The drainage of the western slope of the Sierra Nevada, through seven degrees of latitude, forms several hundred streams, whose united waters make the Sacramento and San Joaquin rivers—the first navigable for a distance of one hundred and eighty miles, and the last navigable one hundred miles from the ocean. The waters from the eastern slope of the Sierra Nevada flow into brackish and salt lakes, in the State of Nevada, having no outlet into the ocean. Pyramid, the largest of these lakes, receiving the waters of the Truckee River, is forty miles long and twenty miles wide. The inland bays and fresh water lakes of California cover more than six hundred and fifty square miles—an area half as large as the State of Rhode Island.

These few statistics are given that it may be clearly understood how extensive is the field over which, under the law, the Board is expected to prevent the wanton destruction of fish and required to compel the owners of dams to permit the free passage of fish to their native spawning beds. When it is further understood that the members of the Board neither receive nor expect compensation for their services other than the satisfaction of doing something towards the preservation of the fish now in our waters and adding to the food supply of the people by the introduction of new varieties, it will be acknowledged that if but a beginning has been made in this work, at least public attention has been called to the importance of the subject. If a few men of intelligence, living on the banks of each bay, river, and lake, will inform themselves of what has been done in other states and countries for the propagation and preservation of fish, they will create a public opinion that will cause the enactment of proper laws and compel their enforcement. The result will be that after a few years our river fisheries will be largely increased, giving employment to a large number of men, and furnishing a cheap supply of nutritious food to many more people.

FISH WAYS

The most important means for the preservation of the fish now in our rivers, is the construction of fish ladders over all dams otherwise impassable. Even traps, nets, and spears will not utterly destroy the fish if some few are permitted to reach their natural spawning beds. It is the instinct of all anadromous fish, after leaving the ocean, to seek the particular stream or rivulet in which they were hatched to deposit their eggs. To reach the particular spot and the parent bed of gravel they will make every effort. Where impassable dams have been placed across the streams, the fish will come year after year and leap by the hour to scale the falls until utterly exhausted. If no means are provided by which the fish can pass the dam, in three or four years the stream above the dam will be without fish. A fish ladder is ordinarily so simple and inexpensive an affair that it would seem that men owning dams would, if informed, construct them without the requirements of a compulsory statute. A good fish ladder for use on our mountain streams is made in the form of a long box of plank, open at both ends, four feet wide and three feet high. One end of the box is fastened at the top of the dam, the other end is extended to and fastened in the center of the pool below the dam. In the inside of the box and fastened on its bottom are pieces of plank about four feet apart, placed transversely, and called "riffles." Each riffle is about a foot high. These riffles do not extend from side to side of the box, but only about two-thirds across. To illustrate: if the first riffle is fastened on the right side of the box at a right angle to its side, it will extend thirty inches across the box; the next, four feet above, will be fastened on the left side of the box and extend thirty inches across it; and so on, alternately, until the top is reached. The water passing into the top of this box is caught by these riffles and diverted right and left by them until it reaches the stream below. The fish coming up the stream to the dam seek and explore every crevice and opening where water is passing. If the lower end of the fish way is placed near the center of the pool below the dam, they readily find it, and immediately enter it. Even if the ladder is placed at so great an angle as forty-five degrees, the fish have no difficulty in passing through it; they will jump through almost any current a distance four feet, and each riffle gives them a resting place behind which they recover for the next jump. At one dam on a tributary of the Truckee a mill owner consented to put in a fish way, at the earnest solicitation of one of the Commissioners, and to prevent the expenses of a suit. He said the law was an infringement of his rights, and when the Legislature passed an act to compel him to spend money in such foolish business they should have appointed a schoolmaster to teach the trout how to use the contrivance; he did not believe a fish could be coaxed to go near it. The next evening after the fish way was placed in position the fish were passing it every few minutes; the mill owner became a convert to the practical use of fish ways. He soon tore away the cheap and temporary affair built to comply with the law under compulsion, and has erected in its place a substantial ladder that will last for years. A fish ladder is but an artificial imitation of the means by which river fish in their annual migration pass up rapids. After reaching the foot of a rapid the fish rest; they will then suddenly dart up the stream and seek shelter in the slack water behind some rocks; here, after more rest, as if to recover strength for the next great exertion, they will dart again and get behind another rock; and so on, until the rapid is passed. From the description given of an ordinary fish ladder, it will be seen that they are easily built and that the cost is but a trifle. The average cost of all fish ladders in Maine, including permanent stone structures over manufacturing dams, does not reach two hundred dollars. Many statistics have been kept showing the increase of fish as a result from the construction of fish ladders, especially in Great Britain. As an illustration, I quote from the report of Charles G. Atkins, Esq., Fish Commissioner of Maine. In comparing the salmon fisheries of Europe with those of Maine, he says: "Their fisheries were nearly exhausted through excessive fishing and the erection of barriers, and by a careful management, including the construction of fish ways, have been made to yield large returns. I will instance the river Galway in Ireland. The salmon fisheries of the Galway are owned

by Thomas Ashworth, who came into possession of them in eighteen hundred and fifty-two. They were in an exhausted condition. Mr. Ashworth had good fish ways built over the dams, of which there was one at the head of the tide; had fishing restricted and protection given to the fish on their breeding grounds. What success attended his efforts is shown by the annual catch as exhibited in the following table:

Year	Salmon
Eighteen hundred and fifty-three	1,603
Eighteen hundred and fifty-four	3,158
Eighteen hundred and fifty-five	5,540
Eighteen hundred and fifty-six	5,371
Eighteen hundred and fifty-seven	4,857
Eighteen hundred and fifty-eight	9,639
Eighteen hundred and fifty-nine	9,240
Eighteen hundred and sixty	3,177
Eighteen hundred and sixty-one	11,051
Eighteen hundred and sixty-two	15,431
Eighteen hundred and sixty-three	17,995
Eighteen hundred and sixty-four	20,512

"Thus the produce of this fishery rose in twelve years from one thousand six hundred and three to twenty thousand five hundred and twelve, and this in spite of a dam at the head of the tide, where five-sixths of all the water is used by mills and canals, only the *one hundred and sixtieth part* running through the fish way, where all the salmon must pass; in spite of civilization, in spite of the disappearance of forests and the cultivation of land. The fish way through which pass all the salmon that ascend this river is supplied with water by a gate two feet square, and through this aperture forty thousand salmon are estimated to have passed in one year."

The law, so far as it relates to fish ladders, appears to operate satisfactorily. Thus far all mill owners on the Truckee and its tributaries, whose dams obstruct the passage of fish, have, with one exception, constructed fish ways. The Commissioners have furnished many mill owners with plans for the construction of fish ways. From our experience during the past two years, it would seem that as a rule the mill owners, with but few exceptions, are a body of intelligent men, who only require to have made clear to them the fact that the construction of fish ways does not interfere with their business, while it adds to the public good, to induce them to place fish ways over their dams.

SALMON

The salmon is the most important visitor to our rivers. It has appropriately been called the "king of fish." The richness of its flesh, its large size, the certainty of its annual return from the ocean, the rapidity with which, under favorable conditions, it is multiplied, all render it an important article of human food. It has probably been the chief source of subsistence to more people than any other fish. The question as to whether the number of salmon is gradually decreasing in the Sacramento and San Joaquin Rivers seems difficult to be answered. Some of the fishermen contend that it is, and others point to the catch of eighteen hundred and seventy in proof that it is not. There are no fish weirs to trap them, and but few dams on the tributaries of these streams to prevent them from reaching their spawning beds. The weight of testimony is on the side of those who believe the quantity to be decreasing; and the most intelligent of the fishermen are so firmly convinced of the fact that they ask that a law be passed and enforced to prevent, for a certain period, the catching of fish while they are filled with ripe spawn. But there is no concurrence as to when this "close time" should be. The fishermen in one part of the river say it should be at one time, and the fishermen in other parts say it should be at others. When the great army is passing by Rio Vista, it would be, in the opinion of the fishermen of Rio Vista, a proper season for a close time at Sacramento and Tehama; and when this army has reached Sacramento, it would, in the opinion of the Sacramento fishermen, be a proper season for a close time at Rio Vista and Tehama. What would be just to all the fishermen, and give the next generation a chance to eat this delicious food, would be to prohibit, by strict law, rigidly enforced,

the catching of salmon by any process during twenty-four hours each week; say, from midnight of Saturday to midnight of Sunday. Probably the most serious cause for the decrease of salmon in our rivers arises from mining. It is the most serious, because it can not be remedied. Formerly salmon were plenty and largely caught by the Indians in Feather River, in the Yuba, and in the American; but of late years they have ceased to visit these rivers. It is not because the waters of these rivers are muddy. All migratory fish that seek rivers in which to deposit their spawn, do so in the season when the freshets cause the water to be muddy. They will pass through muddy water, if beyond they find clear water and clean gravelly bottoms. The gravel beds that formerly existed in these streams are now covered with a deposit of mud, washed down from the mines; and on this the eggs of the salmon will not hatch. Neither will the eggs of the salmon or trout hatch in water containing any considerable quantity of sediment. A small quantity of the finest sediment deposited on the eggs prevents it from hatching.

Salmon, after the second year from being hatched, pass the greater part of the time in the ocean; they there find their principal food. While in fresh water their growth is slow, in salt water they increase in size and weight with great rapidity. They can only breed in shallow streams of cool, fresh water, such as they find in the tributaries of our rivers descending from the mountains. To such places they annually resort; and to reach them, they will make the most extraordinary exertions. Salmon are caught by the Indians in the small streams that empty into the Sacramento from the sides of Mount Shasta, at an elevation of more than four thousand feet above the level of the sea; to reach which they must have passed through at least fifty miles of almost continuous rapids. Bishop Farr states that salmon are also caught in the headwaters of Snake River, east of Salt Lake. As Snake River is a tributary of the Columbia, these fish must annually make a journey into the interior of more than a thousand miles from the ocean.

Some breeding fish enter our rivers during the summer, but they do not deposit their eggs until late in the autumn. During the time they remain in fresh water they lose in weight, and the quality of their flesh deteriorates; its color becomes nearly white, and it ceases to be firm. The great army arrives in our rivers after the first heavy rains. Upon arriving they seek the brackish water in the vicinity of where the salt and fresh waters meet. Here they remain for several days, or perhaps weeks. It is supposed that the brackish water kills the small parasites which attach to them in the ocean. It is this instinct that retains them in brackish water that gives to Rio Vista its prominence as a fishing point.

The salmon, like most other fish, reproduces its kind from eggs which are extruded from the female fish in an undeveloped and infecund state. The male fish performs his office of fecundation after the eggs are in the water. It is a remarkable fact, that the salmon will return, year after year, to deposit its spawn in the particular stream in which it was hatched. Salmon hatched artificially in Scotland and kept in breeding ponds, were, for several years, marked before being dismissed to the ocean; the salmon, thus marked, invariably returned to the stream in which they passed their infancy, and, so far as is known, these marked salmon have never been taken in any other river. The pair having arrived in their parent stream, find a gravel bed, where the water is clear and cold. The female burrows a hole in the gravel about four inches deep, and of a diameter nearly equal to her length, then pressing her body against the upper edge of the hole, the eggs are extruded and fall into this nest. The male, who is in close attendance, extrudes his milt into the water which flows over these eggs, and they are thus fecundated. The female immediately busies herself in covering the eggs with the gravel. This process is again repeated in a few days, as more eggs become ready for extrusion, until the season's work is over, when the fish return, poor and thin, and, after remaining for a short time in brackish water, leave for unknown places in the ocean, to return the following season, largely increased in weight. The only condition requisite for the hatching of the eggs is that cool, pure water, free from dirt or sediment, shall constantly pass over them. In from ninety to one hundred and thirty days the young fish are hatched. For the first twenty or thirty days they require no food,

other than the yolk sac which is attached to them. The young fish remain in the river from one to two years before leaving for the ocean. It has been observed in Scotland, where the artificial breeding of salmon was first largely practiced, that of a given quantity of eggs hatched in one season, about one-half the young fish would leave for the ocean the same year, while the other half would remain until the following season. This has been found to be the unvarying rule. No reason has been assigned why this migratory instinct should control but about half the young fish in the year in which they were hatched, other than that Providence, while apparently not caring for the individual, makes stringent laws for the preservation of the species.

The preservation of our salmon fisheries is a subject of great importance. Salmon were formerly as abundant in the rivers of New England as they are now in California and Oregon: but traps, weirs, ponds, seines, gill nets, and the erection of dams without fish ladders, at last nearly exterminated them. Now these states are making appropriations for the artificial hatching of these fish, and the rivers are being successfully restocked.

So much more is known of the habits of the salmon than formerly, that it is not difficult to determine what may be done to increase the number of fish, and at the same time increase the quantity that may be caught. The men who pursue the business of fishing for salmon, appreciate the necessity for their preservation and acknowledge the propriety of laws requiring a "close time," as well as laws against pounds and weirs, and laws regulating the size of gill nets. We believe the time has arrived when the present and future interests of California require careful and just legislation. We would, therefore, recommend that a standing committee be appointed in both houses of the Legislature on coast and inland fisheries. These committees could visit the fishermen, and, after learning their views, so amend the present law and frame new laws as to protect legitimate fishing, and at the same time provide for an increase of fish in the future.

TROUT

This fish is found in nearly all of the streams that discharge into the Pacific Ocean from the Coast Range of mountains and in the greater number of the mountain streams of the Sierra Nevada. They vary greatly in size and appearance in different waters and at different seasons, but so far no variety is exactly similar to any of the brook trout of the New England states. The large brown and silver trout of Lake Tahoe and the Truckee River are pronounced by Mr. Seth Green—who is considered to be an authority in such matters—not to be trout, but species of the sebago or land-locked salmon. These fish make annual migrations from Lake Tahoe to the brackish waters of Pyramid Lake. Many of the fishermen of Tahoe insist that the so-called silver trout does not leave the lake, but as they are occasionally caught in the river, it is probably they also migrate, but perhaps at an earlier or later season. The habits of the trout are similar to those of the salmon. It seeks a bed of gravel or coarse sand in clear running water, near the head of a stream, burrows a nest and covers its eggs. In the streams of the Coast Range of mountains the trout spawns in November and December; in the streams of the Sierra Nevada in March and April. Trout will also spawn and the eggs will hatch in lakes which are supplied by springs that rise in the bottoms. In this case they will deposit their eggs among the gravel where the spring rises, the motion of the water from the spring having the same effect in bringing the eggs to maturity as the water. It has been observed that there are no trout in our mountain streams above large falls. The trout will migrate from one part of a stream to another. If there were ever trout above these falls they would pass below them in their migrations, and the falls prevent their return. In many places a very little work would create a passage for the fish, which would have the effect of greatly increasing the numbers of this most delicious species. The reports of our assistants, from which we have largely copied, will show how rapid has been the destruction of the trout in this State. It is to be hoped that the dissemination of intelligence as to the construction of fish ladders and the enforcement of the law against trapping and illegal fishing, as well as the

stocking of streams and lakes in which no trout were found, and the restocking of those from which they have disappeared, will have the effect to repair the waste that has been committed. It having been noticed that on many streams on which there were sawmills, the trout after a few years disappeared, it was supposed that the floating sawdust in some manner killed the fish, but as in other streams on which there had been sawmills for years there were still trout to be found, the Maine Commissioners devoted much investigation to solve the mystery. They found that trout readily swam among the floating sawdust, and never seemed to avoid it. At last they ascertained that where the mills were below the gravel spawning beds of the trout the fish were still plenty, but where the mills were above the fish had ceased to be. Wherever the sawdust had sunk and covered the spawning beds, the trout, after a few years, had disappeared, for the trout has the same instinct as the salmon—it returns to spawn in the particular stream in which it was hatched.

Canada, which is in advance of most of our states in her laws for the preservation of her fisheries, forbids, under penalties, all sawmills from running sawdust into the streams. In a short time it will be requisite to pass similar laws in this State, for, in addition to the destruction of trout, the sawdust will cover the spawning beds of the salmon as effectually as the mud from mining has their gravel beds in the American, Yuba, and Feathers rivers. On the Truckee River, about five miles above the town of Truckee, the Brothers Comer have an establishment for the artificial hatching of trout. They have been engaged in this business for the past three years, and have successfully hatched and have in their ponds more than half a million of fish. Their business is a success in every respect except financially. There is not in this State, as yet, a large demand by individuals for the young trout to stock streams, and the feeding of so large a number of fish kept in small ponds requires a considerable outlay. The commissioners have been requested to expend some portion of the appropriation at their disposal in purchasing a part of these young fish to be placed in streams that are now without trout. It would be an appropriation of money within the spirit of the law, but there is some doubt as to whether the wording of the act authorizes this kind of expenditure. Several of the states have hatching houses in which various kinds of fish valuable for food are hatched, and distributed to all who desire to stock lakes and streams. The destruction of our native fish has not gone so far that a similar plan is required in California, but we believe it will be found that the drought of the past two years will have had the effect of materially decreasing the trout in all the streams. The sand and gravel beds at the heads of streams where they deposit their spawn must, to a great extent, have been bared by the receding water before the eggs came to maturity. If authorized, we will expend a portion of the appropriation in purchasing young fish to be distributed to restock streams, or to place in streams and lakes which have no trout in them.

The Comer Brothers procure their eggs for hatching from the fish caught in the small streams that discharge into Lake Tahoe. Their plan of operation is similar to that of other breeders of trout. Having caught a number of trout, male and female, at the season when they commence to go up stream, they are kept in a small trap or pound until the females are found to be ready to deposit their eggs. This can be readily told by an examination of the fish. The first operation is to procure a tin pan or other shallow vessel of water, a male trout is then taken from the pound and his belly placed in the pan, a gentle pressure of the hand will express a few drops of the milt; he is then returned to the pound; a female trout is then taken, and by the same process her eggs are also expressed into the same pan. The water in the pan is then gently stirred so as to insure all the eggs coming in contact with the milt. In a few minutes the water containing the milt is washed away and replaced by pure water. These impregnated eggs are then placed in the hatching boxes, which are a series of shallow wooden boxes nearly filled with fine gravel, over which a stream of pure cool water is slowly but constantly passing. A trout yields from five hundred to four thousand eggs, depending upon its size and age. A salmon yields an average of a thousand eggs to each pound of its weight. The eggs are spread upon the gravel, and after the water has continuously passed over them for

from forty to eighty days, depending upon its temperature, the young trout make their appearance. They require no food for the first thirty days, the yolk sack of the egg, which is attached to them, affording nourishment during this period. After this, the Messrs. Comer feed them on finely chopped liver until they are sufficiently large to be turned into the ponds, where they are fed upon any kind of coarse meat or fish, finely chopped. Trout will live and thrive in water of a temperature between forty and sixty-five degrees. This is about the only question to be settled by persons who desire to stock streams with trout. If the water in summer does not get warmer than sixty-five degrees, the experiment may be tried with every probability of success. The quality of the water does not seem to be material. They live and thrive in water that is impregnated with minerals, and in salt water, and in artesian well water, provided only the temperature is not too warm. Persons who live near small lakes and streams, now without fish, and containing water of the proper temperature, could, at trifling expense and care, provide themselves with a constant supply of delicious and healthy food by hatching a few eggs, or by turning in a few of the young fish. Both eggs and young fish are readily transported almost any distance. Salmon eggs have been taken from Scotland to Australia and hatched, and the Acclimatization Society of San Francisco has successfully imported the eggs of the Eastern brook trout and hatched them in this State. It has been estimated that an acre of water can be made to yield as much food as four acres of average land.

SHAD

Your Commissioners made arrangements with Mr. Seth Green, the noted pisiculturist of Rochester, New York, for the importation of a lot of young shad to be turned into the Sacramento River. No shad proper (*alosa praestabilis*) are found in the rivers of the Pacific Coast, while there are found several varieties of the same family, such as herrings, anchovies, and sardines. As shad readily enter rivers while muddy from the spring freshets, and spawn in water of a temperature as high as sixty-five degrees, there was reason to hope that if the shad could be brought here alive and turned into the river they would find suitable food, and in time go to the ocean and return to propagate their species. As the shad is very prolific, each full grown female yielding from fifty to eighty thousand eggs, and as the flesh is esteemed to be nutritious and valuable food, it was deemed proper to make the first experiment of importing new varieties with the young of this fish. The eggs of the shad are hatched in from two to four days after they are spawned, therefore, if there were no other reason, time alone would prevent the importation of the eggs.

Mr. Green felt so much doubt as to the possibility of transporting the young fish for so great a distance that he determined to superintend the experiment in person. He left Rochester, New York, with an assistant, on the twentieth of June, with fifteen thousand of the young fish just hatched, contained in eight tin cans holding about twelve gallons of water each. The water had to be changed at every convenient opportunity, and as on a part of the journey the weather was quite warm, constant attention had to be given to prevent the water in the cans from reaching a higher temperature than eighty degrees. At Chicago he lost a few fish from a film of oil from the machinery of the waterworks with which the water attempted to be used was covered. At Omaha the river water killed a few; the cause of this he had not time to investigate. The water of Bear River (discharging into Salt Lake) and the waters of the Humboldt and Truckee rivers were found to agree with them and containing plenty of food. Mr. Green arrived on the twenty-seventh of June. As it was advisable to put the young fish in the river at as high a point as was practicable, for the reason that the instinct of the shad is, like that of the salmon, to return to spawn at the same place where it was hatched, they were the same day transferred to the cars of the California and Oregon Railroad and taken to the Sacramento River at Tehama. Here the temperature of the water was found to be sixty degrees of Fahrenheit. Upon dipping up the river water in a glass and pouring a lot of the young fish into it, they were found to be lively and the water to contain large quantities of some minute substance on which they feed. All the conditions being favorable, they were turned loose in their new home. It is expected

they will remain in this river until about January, by which time they will be three or four inches long; they will then go to the ocean, to return the next year weighing from a pound to a pound and a half, ready to commence the increase of their kind. Thus far the experiment has been a success. The water of the river is adapted to them; it contains the proper kind of food for their young, and the waters of our coast are filled with the sand flea, a small species of the shrimp, on which the fish feeds after reaching the salt water. The only thing to be feared is that there may be in the ocean some kind of fish which may so completely exterminate them that none will be left to come back and spawn. If after one or two years even one shad is taken in the river, the result will be satisfactory, as it will demonstrate the fact that all the conditions are favorable to their successful propagation in the waters of our rivers; we could then at trifling expense fill our waters with this valuable fish. When first hatched, and in a condition proper to be transported, one freight car would bring over two million of them. If, after two years, none should be taken, it would not then be well to abandon the experiment.

The English, year after year, shipped impregnated salmon eggs to Australia; the eggs hatched, and the young fish in due time went to the ocean; but for years none were found to return. Some fish—supposed to be the bonita—destroyed them all. At last, after repeated experiments, some escaped, and in eighteen hundred and sixty-seven, large fish, returned from the ocean, were taken in the river. Shad were formerly plentiful in all the rivers emptying into the Atlantic Ocean from Georgia to the St. Lawrence. They, therefore, frequent warmer waters than the salmon. Over-fishing, traps, pounds, weirs, small meshed seines, and dams without fishways at last nearly exterminated them. Through the efforts of the Fish Commissioners of the several eastern states they are again becoming plentiful. For a number of years all efforts at the artificial hatching of the eggs of shad had been failures. It was ascertained that the fish came into the rivers at about the same time as the salmon, but that unlike that fish, they did not spawn until the warm summer months. Their eggs are not placed upon gravel, but float in the water. Schools of them will play about the river for days, when, upon some sudden impulse, the milt from the male and the spawn from the female will be exuded into the water, at times, it is said, making the water cloudy. In from two to four days the eggs hatch, when the young fish immediately swim for the center of the river, keeping their heads against the current. At last Mr. Seth Green, after much patient investigation and numerous experiments, invented a box, the bottom of which was covered with fine wire netting. On this wire netting the impregnated eggs were placed; a series of these boxes, fastened together by a rope, were allowed to float in the current of the river. To the sides of each box were fastened, at an angle, pieces of board, which, floating in the water, caused the wire bottom of the box to be partially turned against the current. The effect was that the current, entering through the wire netting, kept the eggs in constant motion. All the conditions of nature were satisfied, and the experiment became a success. Mr. Green obtained a patent for his invention, which, as it is largely used, is quite valuable. Within the past four years, under the direction of Fish Commissioners and by aid of small appropriations, more than five hundred million shad have been artificially hatched in these boxes in the rivers of the eastern states north from Virginia. The result of the first and second year's hatching in the Hudson and Connecticut is becoming manifest; more fish have been taken this year in those rivers than in any year during the past twenty. So many fish were caught that the fishermen were unable to take care of them, and fresh shad were sold in the New York City markets as low as ten cents a shad.

These results, from the experiments of enthusiasts, in increasing almost without expense the food supply of the people, are worthy the attention of statesmen. So much attention is now being given to the subject that Congress has passed a law appointing a commission to investigate our river and coast fisheries, learn the habits of the fish, and report as to what legislation is required to aid in increasing the food supply from this source.

IMPORTATION OF NEW VARIETIES

Your Commissioners have it in contemplation to attempt, at the proper season next year, the importation from the east of white fish from the Great Lakes, to be placed in Lake Tahoe; black bass, a superior game fish, to be placed in some lake to breed and be distributed; eels, to be put in the Sacramento River; and lobsters, to be deposited in some appropriate place in the bay of San Francisco. We have also opened a correspondence with gentlemen in China, with the object of learning what valuable food-fish can be obtained in that country, and the processes of the Chinese, who are said to pursue largely the artificial hatching of fish. From the following extract from one of the letters received it will be seen that the Chinese have not yet learned how, artificially, to impregnate the spawn, but depend upon catching the eggs for hatching after they have been naturally fecundated. Our correspondent says:

"Referring to your letter of May twenty-fifth, inquiring concerning the manner of breeding fish, we would say that we find the Chinese, at certain periods of the year, spread their cloths across the river at some distance above Canton and catch the eggs which are washed down from the smaller streams and ponds higher up. These eggs have been already impregnated by the male fish at the place in which they are laid, and when thus caught are placed in ponds, where after a short time they hatch and are thus raised. There are no breeding ponds near Canton, and it is said to be impossible to breed fish in ponds on any large scale, as the eggs are devoured by the male fish after impregnation unless he be immediately removed, which is impractical where there are any number. The ponds in which the eggs are placed for hatching must be running water. We would suggest the plan of sending two or three men, acquainted with the process of breeding, to California, where they could experiment on the rivers and lakes, which very much resemble those in the country where it is at present practiced."

EXTRACTS FROM REPORTS

Our field is so extensive and there is so much to be done in the way of investigation preparatory to intelligent legislation on the subject of inland fisheries, that we deemed it advisable to employ two assistants—the first, Captain E. Wakeman, to examine and report on the fisheries of the bay of San Francisco and some of the rivers that discharge their waters directly into the Pacific Ocean; the other, Mr. George C. Haswell, to examine and report upon the fisheries of Lake Tahoe and the Truckee River and its tributaries. The following extracts from their reports will be found of great interest. Referring to the bay fisheries, Captain Wakeman says:

"Since the date of my commission I have visited with the yacht 'George Steers,' repeatedly, all the fishing grounds that are frequented by the Italian and Chinese fishermen in the waters of our bay. The only Chinese fishing station that I find is located a short distance north of the 'Two Sisters.' Here, on an extensive mud flat, are stakes or poles set firmly in the ground, and occupying an area of several miles in extent, from which poles are kept constantly set the nets, which are taken up at each slackwater of the flood and ebb tide. From twelve (12) to fifteen (15) boats are employed, having three (3) men in each boat. Shrimps are taken here and cured for the Chinese market by being boiled in large vats in salt water, then spread out on the cleanly swept ground and dried in the sun, being raked over frequently during the day. The scales or skin become separated from the meat and looks like fine sawdust. The meat and refuse is then sewn up in the best quality of bags and placed on board the Chinese junk of about thirty tons and sent to San Francisco, from whence it is shipped to China. Scare any class of fish are taken in these nets but shrimp, and thousands of tons must find their way to China annually. Their nets are similar to those used by the Italians, with this difference, viz: the middle of the net, which assumes the character of a bag, is, with the Chinese, opened by untying a string, and the whole catch is dropped into the boat with ease. The net is then closed again with the string and put back into the water to remain until next

slack. Three of these nets generally load a large boat, which are all of a large and commodious class.

"Saucelito Bay is constantly used by the Italians, smelt being the principal fish, with soles, flounders, sardines, and anchovies. In some cases nothing but crabs are taken, which destroy the nets and irritate the men so that they are inclined to leave them on the beach to die; but I have had, in all cases, everything that was not marketable put back into the water. In fact, crabs are the only fish that are left upon the beach, all other kinds being taken out of the nets with tin pans, the nets being in about from one to two feet of water. All that part of the catch that is desired is taken and thrown into the boat without coming in contact with the sand and dirt, and the small fish are permitted to remain in the water; nevertheless, large quantities of the young fish die from pressure or other cause arising from the fact that they have been compressed as it were among so many thousand into the contracted space of a few feet, and are unable in their most strenuous efforts to release themselves from their perilous condition.

"They are to be found in large quantities, floating upon the water, completely drowned. Still a very large number revive and swim off again. Whereas, heretofore, the custom appears to have been to dump the whole catch upon the beach and, after picking out all they wanted, the young were invariably left upon the beach, becoming, in many parts, a most intolerable nuisance to persons residing in the vicinity. A new order of things has been inaugurated this year, which is found to work to the mutual benefit of all parties concerned. Five boats are generally to be found in different parts of this bay; and fish are taken at all times of tide, both day and night. Two boats are generally employed between the bay and the Golden Gate. They cast on both shores, north and south, for the same kind of fish; and also in Kashaw's Harbor, two and sometimes three boats are found both night and day, at all times of the tide. During the night fires are made upon the beach, and frequently these fires can be seen, not only on all the different beaches in Saucelito Bay and Kashaw's Harbor, but also on both sides of Raccoon Straits, giving a most picturesque and cheerful aspect during the long and gloomy nights which prevail in most parts of our harbor at this season of the year.

"These Italians are a singular and peculiar people, always sober and industrious, and, like the Chinese, they pursue their avocations in silence. During the silent and tedious hours of the night some are found sleeping in close proximity to the fire, with their harness on, face down, which appears to be the universal practice among all classes of the different races of people who are accustomed to sleep upon the ground in the open air. From Raccoon Straits to the Chinese fishing station, on the north shore, are several favorite places where the nets of the Italians are cast, with various success. The same class of fish being taken from the 'Sisters' up to Petaluma, nothing but sturgeons are found until we come to Vallejo, where there is a mackerel trap fishery.

"Down on the south shore we find two (2) Italian boats on the San Pablo flats, and two more at a favorite point to the north of Sheep Island, where there is another mackerel trap fishery.

"Two boats are employed at Sheep Island. They not only cast upon the beach, but generally fish at night under sail only, pulling round and towing the nets. The same fish, smelts, flounders, sardines, anchovies, and soles, are taken here.

"Two boats are frequently employed around Goat Island, two at Oakland Wharf, and two at Alameda Wharf. Large quantities are taken all along the Alameda Flats, some ten miles to the southward of Alameda, and on the west coast from Redwood Slough, all along until we come to Baybien where there is a favorite resort to repair and dry their nets and take out their boats. From there to Long Bridge boats are generally engaged, and I have in all cases, at each of these points, impressed upon the minds of these men the consequences that will attend any infringement on their part of the laws in regard to the fish interest, and especially of section number six. I have also, in most of these places, made arrangements with those who live near the beach to inform me of the first infringement, by taking the name or number of the boat.

"I am informed from a reliable source that a most wanton course of destruction is practiced by the settlers along the Sacramento and San Joaquin Rivers, which will, if not arrested, be attended with vital consequences, amounting to a total destruction in these waters of our salmon fisheries, which, to the State, are worth millions of dollars.

"Perch, flounders, shrimps, and herring spawn in December; smelt, in August."

From Captain Wakeman's report on the fisheries of some of the coast rivers we make the following extracts:

"In pursuance with your orders of the sixth instant, I have examined all the streams from Spanishtown to Pescadero, and herein submit my report in regard to their character as trout strams, their obstructions, and consequences arising therefrom:

"*Pilarcitos Creek*—Upon which Spanishtown is located, is a dirty red stream, of about two feet wide and one foot deep, and empties its waters upon the beach, about half a mile below the town. There is a steam flour mill here, but no sawmill, and judging from the thick, muddy water, nothing but catfish can live in it.

"*Gobethey Creek*—Two miles below Spanishtown, is a clear water trout stream, about two feet wide and a few inches deep, and empties its waters upon the beach. There are no mills upon this stream, and only natural obstructions, such as old decayed trees and their branches.

"*Purissima*, or Pure Water Stream—Is two miles below Gobethey Creek, and is a fine clear water trout stream, about four feet wide and a foot deep. Generally at this season (February) it has a volume of about ten feet in width and five feet in depth. It empties its waters upon the beach about half a mile below the Purissima House. Four miles up the stream is the sawmill belonging to Messrs. Boyden and Hatch. This mill has an overshot wheel, the water to run it being taken from the stream three-fourths of a mile above and carried in a sixteen-inch flume, at the head of which are four little dams, made by throwing a short log across and tamping it tight with a few bags of sawdust. This throws all the water into the flume and only half fills it, which shows that this stream is very small at the present time. A site for a new steam sawmill is being located two miles further up. The sawdust and blocks of the redwood are thrown into the stream, which turns the water to a dark red, and, in some places, to an inky black; in other places to a purple. This is poisonous, and kills the fish in half an hour after it is drank, according to the testimony of Messrs. Boyden and Hatch themselves. Cattle along this stream are walking skeletons. I saw several carcasses of dead animals lying along the bank, notwithstanding there is plenty of good grass. This shows conclusively the truth of all the reports made to me by many of the settlers along the stream. In places where the water runs fast it is quite palatable; but where it is still it becomes wholly unfit for use, and not only kills the fish, but is dangerous to the cattle. At some seasons of the year the settlers are obliged to sink holes or wells back from the stream, and even then the water is impregnated with an odor only to be derived from dead fish.

"*Lobetis Creek*—Is a clear water trout stream, two miles from Purissima, about three feet wide, and a foot deep. It empties its waters upon the beach, and has no mills—nothing but natural obstructions.

"*Tunis Creek*—Is a clear water trout stream, of about the same volume as Lobetis. It empties its waters upon the beach. Ten miles up this stream is Foment's steam sawmill, not running now, owing to a lawsuit pending and an injunction from the court; which last, it is to be hoped, may continue for all time, as the sawdust, so fatal to the fish and injurious to the farmer, is prevented thereby from being dumped into the stream.

"*San Gregoria*—Is a fine clear water trout stream, four miles from Tunis, and connects with the ocean about one mile below the San Gregoria House. At full sea, the salmon, of from fifteen to twenty pounds, and the silver salmon, from two to fifteen pounds, enter this stream during their spawning season, which is from

October to March, when they go out to sea again. These fish have been taken several miles up the stream during the rainy season, when, owing to the strong current, most of the sawdust had been washed out. Six miles up this stream is Templeton's steam sawmill, and a few miles further up, on a northern branch of this stream, is Gilbert sluice mill, and a few miles further up the same branch is L. P. Pharis' steam shingle mill. All these mills dump their sawdust and blocks into the stream, which so poisons the water that it has become an intolerable nuisance to all the settlers along the stream below, and will soon exterminate the trout.

"*Pompona Creek*—Is four miles from San Gregoria, and is a clear water trout stream of small volume emptying upon the beach. No mills; plenty of trout.

"*Pescadero stream*—Is three miles from Pompona Creek, and is a fine clear water trout stream, empties into the sea about two miles below the town, and connects, one mile from the beach, with the Butena River, which is also a fine clear water trout stream running to the southeast; is about twenty feet wide, and six feet deep. For six miles this makes a fine resort for the salmon and silver salmon from the sea which frequent these waters, with other lesser sea fish, for the purpose of spawning. From October to March a wagon load of these beautiful fish, weighing from two to thirty pounds, are taken daily and sold all along the road, as high up as Spanishtown, at seventy-five cents per pound. These fish are only taken during the spawning season, they being a deep water fish and go out to sea in March. Three miles up the Pescadero stream—which is about four feet wide and a foot deep, at present—is B. Hayward's steam sawmill, and three miles further up is Anderson's sawmill, run by a turbine wheel, having a well constructed dam, built of hewn logs, well secured right across the creek. The dam is twenty feet long and about ten feet high, built in eighteen hundred and sixty-two, and all the water from above passes at present through the sluiceway at the turbine wheel. As the water has never been half way up to the top of this dam since it was built, no fish have ever passed. A sluice box with stop waters in it for fish could be introduced through this dam near its base and outside the sluiceway for the wheel, this being the only place where the box could reach the water below, as all the rest of the bed of the stream is dry. Large quantities of sawdust and blocks are deposited in the stream below the dam; fish are found dead, their eyes eaten out by the strong poisonous acids in the water, and their bodies covered beneath the skin with disgusting blisters, like the smallpox, whilst the inside is as black as ink. The waters are rendered at times wholly unfit for use. Eight miles further up this stream is Wolf's steam sawmill, the lumber from which is hauled out to the eastward, whilst the sawdust is conveyed down the river, fatal to the fish and to the interests of everybody. There is but one sentiment existing among the settlers along the stream, and it is this: that they have arrived at a point where forbearance ceases to be a virtue, and have resolved to exhaust all legal measures, by their united efforts and similar means to protect their interests against the oppressive and persistent practice of the mill owners in dumping the sawdust into the streams, whereby the whole community below suffer, some hundreds and others thousands of dollars. The effects of the sawmills, during eighteen or twenty years, are scarcely perceptible in these almost impenetrable forests, and the united efforts of many mills for the next twenty years will be required before the woodman's axe will have wrung from the settlers of this nature's retreat in her solitude that beautiful prayer of 'Woodman, spare that tree.'

"I have communicated with many of the settlers along the banks of all these streams, and have the experience of the oldest settlers in this part of the country, and there can be but one conclusion in regard to the fish interest of these streams, and that is that the redwood sawdust poisons the water, and unless some other method is adopted to get rid of it, such as burning it or repairing roads with it, there will not be a breed of trout left in a few years. Where thousands were taken daily (thirteen hundred by one person), now scarcely a trout can be seen. If there are laws to protect them I can see no good reason for not enforcing them, and if this be done every man's table in this district will be abundantly supplied with trout —a healthy and cheap article of food—while large quantities will find their way, as a

luxury, to the rich man's table at a distance, so long as these streams shall flow 'from the mountain to the sea.'"

From the report of Mr. Haswell on the Truckee River and Lake Tahoe we make the following extracts. He says:

"Under your appointment, and in accordance with your instructions, I proceeded to that point on the Truckee River where it crosses our State line on its way to Pyramid Lake, in the State of Nevada. From thence I followed it up to its head, in Lake Tahoe. I also examined the California part of that lake; also Donner Lake and Donner Creek; but from want of sufficient time could only make inquiries about the Little Truckee and its sources, Webber Lake, and Lake Independence, though prior to my appointment I had visited them all for health and pleasure.

"During this official visit I heard and saw so much that requires the most stringent legislation in both states that I scarce know where to commence my report. But as a preliminary I suggest that carefully drawn laws, precisely similar in all respects, except the mere verbiage that is necessary to designate which State enacted them, be passed by each State, and that, if such a law is not unconstitutional, each act shall authorize the officers of the other State, armed with a proper writ from it, and any citizen of the other State who has seen the offense committed within its borders, to cross the line and make the necessary arrest, and without further ceremony take the prisoners back for trial. This seems arbitrary, but if it can be constitutionally made a law it will be found to be one of the greatest safeguards to the joint fisheries.

"Trout commence running up the Truckee, from Nevada, with the first sufficient rise of the river. The date of this, as also that of their return, is of course variable. They retire towards Pyramid Lake as the water recedes in the summer or fall.

"From the obstructions hitherto placed in this river and the various means used to entrap the fish before they reach the shallow, gravelly streams, together with the wholesale waste of them and the criminal distruction of their spawn, I believe that in a very few years the great lakes of both states will be entirely without brown trout, and certainly very few silver ones, unless the two state governments concur in some such law as that above suggested. But to return to my starting point—the Truckee at the boundary line.

"The first mill and dam (all the mills on this river are for sawing lumber) on the Truckee in California, is that of Pray & Bragg. At present it is little or no obstruction to the free run of the fish, and its owners have agreed that if it becomes one they will either open the dam itself or construct proper fish ways and ladders.

"The Boca Mill Company comes next. Mr. Doane, the resident partner, is about as enthusiastic on the subject of letting the trout have a clear passage to and fro between the lake and streams of this State and those of Nevada, as the members of your body themselves. At this dam there are two good fish ways—one on a plan recommended by yourselves, and the other built upon a design which Mr. Doane and the other members of the company think superior to it.

"The dam of the Marysville Company follows, then that of the Geissendoffer Mill Company, then in succession two others known as Proctor's. Neither one of these four is an impediment now. The mills have been removed, the sluiceways are open, and the dams themselves are all so dilapidated that the fish can pass through either of them.

"Succeeding the upper Proctor mill come five dams belonging to the Truckee Lumber Company. Four of these are mere dams to catch water when the river is low. They cause no hindrance whatever. The other one has an excellent and very efficient passageway, but a log got entangled in it and carried off a portion of the crossbars or resting places. The owners said that the necessary repairs should be made forthwith; and as they seem to take as much pride as the owners of the Boca Mill do in giving the trout fair play, I do not consider that it requires any further attention.

"I am sorry that I can not say the same of the next place—Rusch's Mill. Here is a so-called fish way which is of no possible use if it was constructed with a

view to allow the fish a passage up stream. If, on the contrary, it was built to be a most efficient trapping place, the intent was fully carried out. But the owner has promised that no further action need be taken, as he would as soon as possible either build a new passageway or else alter the present one to meet the requirements of the law.

"Except as above stated the fish have proper passageway in the Truckee to and fro from the State line to the debouchment of Lake Tahoe.

"According to your instructions, I returned from the lake to the line and crossed into Nevada to confer with the citizens of our sister State about opening the Truckee on their side so as to give the fish a perfect free way whenever they deemed proper to use it between the fresh waters of Tahoe and the brackish waters of Pyramid. The people there took the matter in hand. The owner of the only obstruction on the Nevada portion of the river was applied to, to either have fishways made, or in some manner give the fish a chance. He declined; but a little giant powder, used by some unknown hand, made the condition of things about that dam entirely favorable for the trout to indulge their migratory propensities.

"Donner Lake empties through a short creek, also called Donner, into the Truckee about fifteen miles below where that river leaves Tahoe. On Donner Creek I found a dam so constructed that no fish once leaving Donner Lake on its way down to the brackish waters of Lake Pyramid could ever get back again to breed. The consequence of this is that brown trout, which I believe always yearly go or at least start to go to the great Nevada lake, in Donner are extremely scarce, whilst the silver trout, which I think never, or if at all, but seldom, go down stream beyond the lake they first reached from their hatching grounds, are moderately plentiful.

"I may as well remark here that the above is my opinion as to the one kind coming down stream out of the lakes, and the other not doing so, at least not as a general natural instinct, though individual exceptions may occur. But it is contended that there is no distinction in species between the two kinds I designate as silver and brown trout—in fact, that they are the same thing—the apparent difference being merely local caused by the nature and color of the gravel in which they were hatched, and the peculiarities of the water in which they grew or live. Such may be the case, but I have examined a considerable number of both colors, and caught a good many trout in the Atlantic States in my younger days, and I consider that what I here call the brown trout is not the same as what was called the brook trout in that part of the country where I was born and brought up and caught fish. In every trout I have examined here the brown ones have a straight purplish line on each side of the body from almost the end of its nose to near the tail. This line is not on the silver ones, and on the brown ones I have never found any of the spots or dots usual on all trout below the purplish line. They have invariably been above it. If I remember correctly, the Eastern brook trout have nothing of the purplish line, but merely spots or dots. Not being an ichthyologist I merely call the attention of the Board to what I believe, from my own observation, and ask you and others who read this report to examine this question and another—are there any trout, either in this State or Nevada, except, perhaps, in the pure mountain streams further north? Whilst upon the Truckee and the lakes I heard several persons, who have the reputation of being ichthyologists, say that all the fish that we call trout, were in reality land-locked salmon, frequently called schoodic trout. But to return to the trap on Donner Creek. I could not find the owners of this dam, but learned that they were A. C. Toll and Brothers. I afterwards understood from Commissioner Redding that they had promised him that they would either remove the dam entirely or put in satisfactory ways and ladders.

"At the source of the Truckee, *i.e.*, Lake Tahoe, two persons have been and I believe that, to some extent, they are still in the habit of taking the fish by means of seines, nets, and traps, on the alleged pretense of catching them for their spawn to stock lakes, streams, and ponds. But the fact is they catch them at all times of the year, and sell immense quantities, without reference to either spawn or spawning season; and, although I did not see it, and can scarcely believe it, I have been informed by their neighbors of credibility that fish and spawn were dipped out by

the bucketful, and either consumed on the place or sold to others for hog feed. Of course, I notified these men of the provisions of the law, and forbid the further use of either seine, net, or trap at any season of the year, or for any purpose whatever. They promised obedience, and the residents of the vicinity said that they would take care that the law was complied with, and in the event of any violation the parties should be prosecuted with the greatest rigor to the utmost extent of the law.

"At the mouth of or a short distance up almost every small stream—the trout's breeding place—that empties either into the Truckee River, or Tahoe, Donner, or other lakes, fish traps are set in such a manner as to be actual murder to most of the fish, and complete destruction to their spawn. Taking advantage of the fish's instinct of procreation and continuance of its race, and of its other instinct, that that can only be done by going up stream to shallow water and a gravelly bottom, a trap is made, which is done as follows: A row of stakes is driven across the full width of the stream. These are not placed so close as to prevent the water coming down, yet are put so near that a trout can not get through to go up. Further down the stream another row is driven across. This is in every respect like the first, except that in one portion of it—about the center—an opening, say, a foot wide and two or three feet long, is left under water. The distance between the two rows of stakes is a matter of option, being from three or four feet to ten or twelve, depending somewhat upon the number of prisoners the owner expects to take, and how long, and for what purpose he intends to keep them. It will be seen that the fish can get in through the lower tier but not out through the upper one, yet might escape by returning; but this they will not do. Fish always return to spawn at the spawning place of their parents. Here they are, and reasoning, nature, instinct, or whatever else people may choose to term it, tells the fish that they are of no further use in the waters of this world unless they get up the stream to spawn and milt. So in this trap they remain, butting their heads against the upper stakes until they are either taken out or the growing ova and milt compels them to violate the laws of nature and die, when the fish and what should have been their descendants are dipped out and, as already said, given to the hogs. Trout are frequently thrown out with their noses absolutely butted off in the vain endeavor to force their way through the barricade.

"The Indians, and a good many whites, have another distinctive method of trapping trout, but it is nothing like so bad as the one described above. Even where there are good ladders and ways, a large number of fish try to run up the current pouring over the dam. After repeated efforts to run up on the face of the water against the impetus with which it is coming down, they become weak and exhausted, and can no longer keep upon the face of the stream and fall through it into the vacant space that is always found under the water that pours over a dam. In this space wicker or other baskets (the Indians use willow twigs) are fastened, and into these baskets the fish fall in great numbers, and of course can not escape.

"Two facts show conclusively that trout are fast disappearing from the lakes. One is, that very few, comparatively speaking, are caught now, even in the best seasons, with the hook and line. As a sample, I may tell of a Sacramento attorney who is noted as an expert in fishing—a gentleman who can nearly equal Izaak Walton for patience in wating for a nibble—who spent some four or five days this summer fishing on Donner. He was out by daylight, and did not return until dark, and the greatest number he caught in any one day was five. I may also state that every trout that he caught was silver—there was not a brown one in the whole number. The other fact is, that the so-called chub, the natural, as it would seem, food for the trout in the lakes, have of late years increased in such numbers as almost to be a nuisance.

"On the Truckee, about nine miles from Tahoe, Comer Brothers have a large establishment for rearing trout. I understand that it was started about three years ago, and that although it has been a success so far as to growing and distributing the fish, yet, in commercial parlance, it has been something very near a failure. I was told that Webber Lake was stocked from the Truckee several years ago, and that it is now well filled with good sized fish, though formerly it did not possess any

trout. If there is any means by which your Board can aid these pioneer California trout growers, I trust that you will do so.

"I believe that I have nothing to add, except to say that during the coming year and until people begin to understand the law, and the officers and courts enforce it, the entire time of at least one man will be required about Lake Tahoe, the Truckee, Little Truckee, and the lakes and streams that flow into them, for the protection of fish."

EXPENDITURES

Of the appropriation of five thousand dollars made by the Legislature to aid the Commissioners in importing new varieties of fish, and in preserving the native fish valuable for food, we have expended the following amounts:

1870		
Dec. 9th	Paid J. D. Farwell & Co. bill of sundries	$40.32
1871		
Feb. 9th	Paid expenses of E. Wakeman, examinations Bay of San Francisco	238.60
March 20th		
March 27th	Paid Bugbey & Sons, drawings of fish ladders	25.00
July 8th	Paid expenses of E. Wakeman, coast rivers	80.00
	Paid expenses of Seth Green and assistant in San Francisco	43.50
July 8th	Paid expenses of Seth Green and assistant in importing 15,000 young shad	348.30
July 8th	Paid fare of Green and assistant, return trip	186.50
Nov. 25th	Paid expenses of G. C. Haswell, examination of Lake Tahoe, Truckee River, and tributaries	175.00
	Total amount expended	$1,137.22

All of which is respectfully submitted.

B. B. Redding,
S. R. Throckmorton,
J. D. Farwell,
Commissioners.

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Report of Commissioners of Fisheries of the State of California for the Years 1872 and 1873

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REPORT OF THE COMMISSIONERS OF FISHERIES OF THE STATE OF CALIFORNIA FOR THE YEARS 1872 AND 1873

REPORT

To His Excellency NEWTON BOOTH,
Governor of California:

The Commissioners of Fisheries for the State of California, appointed under an act of the Legislature entitled "An act to provide for the restoration and preservation of fish in waters of this State," approved April second, eighteen hundred and seventy, respectfully submit their Second Biennial Report.

REPORT

Your Commissioners, in pursuance of the plan contemplated in their last report, proceeded to open correspondence with the most noted fish culturists in the east, and also with the United States Fish Commissioner at Washington City, upon the subject of obtaining an additional supply of shad, and also a large variety of other food fishes from the eastern lakes and sea coast.

By the kindness of the United States Commissioner of Fisheries, the Hon. Spencer F. Baird, we were allowed to avail ourselves of the services of Mr. Livingstone Stone, attached to the United States Commission, and engaged in transferring salmon eggs from California to the waters flowing into the Atlantic. Mr. Stone's high reputation as a successful breeder of fish, as well as a writer upon the subject of Pisciculture, not only gave us confidence in the success of the enterprise, but also led us to enlarge and amplify the scope and range of the undertaking.

In this view we made arrangements with Mr. Stone, for him to proceed to the eastern states, and there collect a supply of shad, eels, black bass, white fish, Tautogs, striped bass, blue fish, and lobsters.

To carry into effect these plans, we chartered from the Central Pacific R. R. Co. a special car, to be placed at our disposal at a given point at the east, and there to await the necessary time for being fitted up for the purpose, and to receive its freight of living fish. All the requisite arrangements for the transit of this car over the different lines of roads, as well as for its necessary stoppages and delays at different points where fish were to be taken in, had been most completely made by our colleague, Mr. B. B. Redding, through the agency of the different railroad managers; and on the seventeenth day of March, 1873, Mr. Stone left San Francisco, to carry out, if possible, the plan of your Commissioners, to transport a car-load of living fish from the Atlantic to the Pacific Ocean.

Referring to this expedition Mr. Stone says:

In accordance with instructions received from the Fish Commissioners of the State of California, I left San Francisco for the eastern

coast on the seventeenth day of March, 1873, for the purpose of procuring a stock of the best varieties of eastern fish, and transporting them alive across the continent, with a view to introducing these varieties into the public waters of California.

My plan of operations for the whole undertaking was: First—To collect the fish at some favorable point at the East, where they could be kept alive until everything was ready for the journey. Second—To fit up a car with the apparatus most suitable for transporting living fish. And third—To take this car when loaded, to California, in the least possible time, and without any transfer of its contents. This plan was successfully carried into practice up to the time of the accident just beyond Omaha.

The first installment of living fish intended for the California car, arrived at Charlestown, New Hampshire, the point of rendezvous, on the seventh of May. It consisted of eighty-two Black Bass, *Grystes salmoides*, Glass-eyed perch, *Lucio perca*, and Bull heads, *Penrelodus*, and about three hundred thousand eggs of the *Perca flauescens* and the *Lucio perca*.

These fish were collected at Lake Champlain, and at the Missisquoi River in Vermont, and were taken a journey of thirty hours by rail, before reaching Charlestown. They nevertheless bore their trip admirably, and arrived at their destination in first rate order.

The next two weeks were spent in fitting up the car which had arrived at Charlestown, N. H., and making other preparations for the difficult undertaking in prospect. Arrangements had been previously made, at the suggestion of Hon. Spencer F. Baird, U. S. Commissioner of Fisheries, with Mr. Myron Green, at Castleton, on the Hudson, for a supply of young Shad, and fresh water Eels.

And also, with Capt. Orinal Edwards, of Woods Hole, Mass., for young Lobsters, and other salt fish. The Eastern Trout, Salmon fontanalis, were to be taken from the Cold Spring Trout Ponds, at Charlestown. The large Lobsters were to come from Johnson & Lorings' establishment, at Boston, and Mr. Myron Green was dispatched to the Raritan River for Catfish.

The equipment of the car having been completed, and everything being ready, the third day of June, 1873, was set for our departure. At midnight of June 2d, Mr. W. S. Perrin arrived from Boston with a special car having on board the Lobsters, Oysters, small Lobsters, salt water Eels, Tautogs, and reserves of ocean water. We began at daylight the next morning, filling the tanks in the car and loading in the fish, and by one o'clock in the afternoon, everything was ready, and at a quarter past two on Tuesday, June 3d, the California Aquarium Car started on its journey.

The car was furnished by the Central Pacific R. R. Co., and was one of their fruit cars, intended for quick trips across the continent. It was twenty-seven feet long and eight feet wide, and was provided with a Westinghouse airbrake and Miller platform, which enabled us to take it along with passenger trains.

At one end of the car was a stationary tank, built of two-inch plank, lined with zinc, and occupying the whole width of the car, and eight feet of its length.

This tank was two feet and eight inches deep, and held, when full, about ten thousand pounds of water.

At the other end of the car was a large ice box, the reserves of sea water, six large cases of lobsters, and a barrel of oysters.

In the center of the car, and occupying nearly all the room in it, were the other portable tanks for carrying the fish. Our beds were on the top of the large stationary tank, which, of course was covered. The large tank was also arranged so that we could take on water on a large scale from the water works at the railroad stations en route. This proved to be a very great convenience, and was in fact indispensable.

When we left Charlestown, N. H., the car contained upward of—

60 Black Bass from Lake Champlain—*Grystes fasciatus.*
11 Glass-eyed Perch, from Lake Champlain—*Lucio perca.*
110 Yellow Perch from Missisquoi River—*Perca flavescens.*
80 Young Yellow Perch from Missisquoi River—*Perca flavescens.*
12 Bull Heads (Horn pouts), from Missisquoi River—*Pimelodus.*
110 Catfish from Raritan River—*Pimelodus.*
20 Tautogs from near Martha's Vineyard—*Tautoga Americana.*
1500 Salt Water Eels from Martha's Vineyard—*Anguilla.*
1000 Young Trout from Charlestown, N. H., *Salmo fontinalis.*
162 Lobsters from Massachusetts Bay and Wood's Hole.
1 Barrel of Oysters from Massachusetts Bay.
Supplies of Minnows for feed fish.

The Black Bass, Bull Heads, Cat Fish, and part of the Lobsters, were full grown and heavy with spawn.

Besides the fish above enumerated, I took on at Albany—

40,000 Fresh Water Eels from the Hudson, and arranged for 20,000 Shad and Shad Eggs, Alosa praestabilis, from the Hudson, to overtake us at Chicago.

The receptacles for holding the fish consisted of—

1 large stationary tank, 8 feet square and 2 feet 8 inches deep.
1 round wooden 70-gallon tank.
1 round 50-gallon tank.
3 round 30-gallon tanks.
3 conical-shaped 30-gallon tanks.
6 conical 10-gallon tin cans.
1 conical 15-gallon tin can.
3 round 9-gallon tin cans.
2 thirty-five gallon casks.
6 large cases (containing the Lobsters).

The total capacity of the whole, excluding the Lobster cases, being about 16,000 pounds of water.

Besides the vessels for holding the fish the car contained the following articles:

1 large 120-gallon cask, filled with ocean water.
1 sixty-gallon cask, filled with ocean water.
1 large ice box.
½ barrel of live moss.
½ barrel of water plants.
Curd and meal for feed.
1 bushel of salt for killing parasites.

The aerating apparatus referred to—

1 alcohol stove.
1 set carpenter's tools.
2 lanterns.
2 hammocks.
2 spring beds.
2 mattresses and pillow.
2 sets bedclothes.
1 broom.
1 lot green sod.
2 thermometers.
Pipes, spouts, and syphons, for taking in and letting off water.
1 long-handled dip net.
2 short-handled dip nets.
Movable steps to door of car.
Sundry barrels, pails, dippers, etc.
Maps, with stations marked where we knew the water to be good or bad.
Our trunks, valises, and private baggage.

When the car left Charlestown there were four of us in it—Mr. W. T. Perrin, of Grantville, Mass.; Mr. Myron Green, of Highgate, Vermont; Mr. Edward Osgood, of Charlestown, N. H., and myself. We arrived at Albany at 11.30 p.m. the same evening, all the fish doing well, and the water in the tanks standing at 45 degrees F. Here we took on the 40,000 Eels mentioned above, and half a ton of ice. We also left Mr. Myron Green here to go to the New York Shad Hatching Works, at Castleton on the Hudson, and get a supply of young Shad.

On my urgent application to the New York Central Railroad authorities, that road took us with their passenger train, which was due to leave Albany at 2.40 a.m. on the same night. We reached Suspension Bridge about noon and left for Detroit with a passenger train on the Great Western Railroad. We took on ice and water at Hamilton, Canada, and reached the boat at Detroit ferry about 11 p.m. the same day, Wednesday, June 4th, all the fish being in good order, except the Lobsters, which were dying in considerable numbers. The ferry boat being just filled, without the Aquariam Car, they left us east of the river all night, and it being very warm, I spent the rest of the night till daylight looking up ice, of which I at last obtained a ton and a half.

Leaving Detroit that morning—Thursday, June 5th—we proceeded directly to Niles, Michigan, with a passenger train, via the Michigan Central Railroad. We had now come all the way with passenger trains, and had we known this beforehand we need not have lost any time in bringing on the Shad; as it was, however, we expected to make slow time on freight trains from Albany to Chicago, and I here arranged to have the Shad brought on by express from Albany two days after we left that point. These two days we had now on our hands, and it was very aggravating to be obliged to lose so much time when time was so precious. There was no help for it, however, and as I thought it would be better to wait part of the time on the road than to spend the whole of the two days in Chicago, I had the car dropped at Niles, Michigan, and we remained there till 6.10 the next morning—Friday, June 6th—when we went on to Chicago, after taking on ice

and water, and catching some minnows to feed the large fish with. We entered Chicago about 10 o'clock on Friday morning, all the fish doing well, except the Lobsters and Eels.

The temperatures at which I aimed to keep the different varieties of fish, were as follows:

	Fahrenheit
Catfish	50 deg.
Fresh Water Eels	45 to 50 deg.
Tautogs	45 deg.
Salt Water Eels	45 deg.
Black Bass	42 deg.
Yellow Perch	42 deg.
Bullheads	42 deg.
Glass-eyed Perch	42 deg.
Trout	38 deg.
Lobsters	34 to 36 deg.
Oysters	34 to 36 deg.

From the experience which I have now had, however, I would advise a change with some of the fish, which would make the temperature as follows:

	Fahrenheit
Catfish	50 deg.
Fresh Water Eels	50 deg.
Bullheads	48 deg.
Glass-eyed Perch	48 deg.
Yellow Perch	45 to 48 deg.
Black Bass	42 to 45 deg.
Salt Water Eels	42 to 45 deg.
Tautogs	42 to 45 deg.
Trout	36 to 38 deg.
Lobsters	36 to 38 deg.
Oysters	34 to 36 deg.

Mr. Myron Green rejoined us with the Shad the next morning, Saturday, June 7th, and at 10.15 a.m. the same day, after having taken on three tons of ice and three tons of Lake Michigan water, we left Chicago for Omaha, via the Chicago and Northwestern Railroad.

We took on water again at Cedar Rapids, Iowa, and arrived at Omaha, at 11 o'clock, on the morning of Sunday, June 8th. Through the courtesy of Mr. C. B. Havens, the train dispatcher of the Union Pacific Railroad, who detailed an engine to take our car to the ice house at the Union Pacific shops, we were enabled to take on a ton and a half of ice, and about one o'clock we started westward again. We were now on our sixth day out, and everything was promising well. All the dead eels had been removed, and we had 20,000 or 30,000 left. The mortality of the lobsters was on the decrease, and we still had over forty alive and in good condition. All the other fish were in splendid order. We had ice and water enough on board to take us, if necessary to the Sierra Nevada—certainly with what supplies we could get in the Wahsatch Mountains, where the water is good. The circumstance of the fish having lived so well up to this time, gave us a good deal of confidence, and we were encouraged to hope that they would continue to do well to the end of their journey.

After leaving Omaha we stowed away as well as we could the immense amount of ice we had on the car, and having regulated the temperature of all the tanks, and aerated the water all around, we made our tea and were sitting down to dinner, when suddenly there came a terrible crash, and tanks, ice, and everything in the car seemed to strike us in every direction. We were, every one of us, at once wedged in by the heavy weights upon us, so that we could not move or stir. A

moment after, the car began to fill rapidly with water, and the heavy weights upon us began to loosen, and, in some unaccountable way, we were washed out into the river. Swimming around our car, we climbed up on one end of it, which was still out of water, and looked around to see where we were. We found our car detached from the train, both couplings having parted. The tender was out of sight, and the upper end of our car resting on it. The engine was three-fourths under water, and one man in the engine cab crushed to death. Two men were floating down the swift current in a drowning condition, and the balance of the train still stood on the track, with the forward car within a very few inches of the water's edge. The Westinghouse air-brake had saved the train. If we had been without it, the destruction would have been fearful.

One look was sufficient to show that the contents of the Aquarium Car were a total loss. No care or labor had been spared in bringing the fish to this point, and now, almost on the verge of success, everything was lost.

I immediately telegraphed the state of affairs to Mr. S. R. Throckmorton, Chairman of the California Fish Commissioners, and to Hon. Spencer F. Baird, the head of the U. S. Commission at Washington. I received instructions by telegraph, the next morning to return East immediately with my assistants, and take on a shipment of young Shad to California, under the auspices of the United States Fish Commission.

In pursuance of these instructions, I went East, and having obtained 40,000 young Shad from the New York State Hatching Works, at Castleton, on the Hudson, I left Albany a second time, at 11.30 p.m. on the 25th of June, 1873, in company with Mr. W. T. Perrin and Mr. Myron Green, my assistants on the Aquarium Car. We were also accompanied as far as Omaha on this trip by Mr. H. M. Webster, whose experience in carrying live Shad was, in this instance, of the greatest value.

On our arrival at Ogden, Utah, I left 5,000 of the Shad, in first-rate order, in charge of Mr. Rockwood, Superintendent of Fisheries at Salt Lake City, to be introduced into Great Salt Lake, and continued with the other 35,000 to Sacramento, Cal., where we arrived at half past one in the afternoon of the second day of July—the fish appearing in every respect as fresh and lively as when they left the Hudson a week before.

We deposited them that night, at ten minutes past nine, in the Sacramento River, just above the Railroad Bridge, at Tehama—the whole undertaking from beginning to end, having been a perfect success.

Immediately upon hearing of the loss of the Aquarium car, we telegraphed a remittance to Mr. Stone at Omaha, and directed him to repair at once to the Hudson River, and bring out, while yet in time, all the young Shad which his now reduced facilities would permit.

Mr. Stone at once proceeded East and, communicating, by telegram, with Mr. Spencer F. Baird, U. S. Fish Commissioner, received from him not only prompt attention but was also furnished by Mr. Baird, for the California Commission, all of the Shad which the U. S. Commission could spare, forty thousand in number, which were immediately sent through to California, at the expense of the U. S. Fish Commission, under the care of Mr. Stone, free of all charges, for

which and for the many kind and valuable aids extended to us by Mr. Baird, this Commission takes this public opportunity of returning their most grateful thanks.

Upon receiving advice of the approach of this shipment, one of the Commissioners repaired to Sacramento, and there met the incoming car with a fresh supply of water and ice. The little immigrants were found to be all alive and in excellent spirits, and after receiving a fresh supply of ice and water, proceeded on their journey to Tehama, on the Sacramento River, and there that same night they were successfully placed in the waters which flow into the Pacific.

In the Spring of eighteen hundred and seventy-two, we opened correspondence with Mr. Seth Green for an additional supply of Shad, but the early Summer and excessive heat of the Eastern States at that time compelled us to abandon the attempt for the season.

In the meantime, viz., in the Fall of 1872, we received advice of a shipment made to us by Mr. Baird, of White Fish Eggs, and we immediately took measures to hatch them and place them in the waters of the State.

In view of this we caused an examination of the different lakes into which they could be placed with the best prospect of success, which resulted in our selecting Clear Lake as affording most of the necessary conditions. Among these conditions is an essential one, namely: That it may be seined without destroying other valuable fish, there being few or no fish in that lake the destruction of which by seining would be any loss, or which at any rate would not be most profitably replaced by the White Fish which can be taken only by seining or trapping. The climate also of Clear Lake seemed to us to be the best within reach, remembering always that the eggs of the White Fish are very delicate and will not bear rough transportation; as it was, in the first attempt all of the eggs perished, and in the second effort, although great pains were taken, a very large proportion of the eggs perished on the way.

Having selected what we deemed a proper place, we erected a hatching house under the charge of Mr. J. G. Woodbury, of whom we take pleasure in speaking as a skillful, careful, intelligent, and economical manager. Mr. Woodbury conducted the hatching of these eggs with great success, and closed his labors with putting into Clear Lake twenty-five thousand living and healthy young White Fish, from which we may reasonably hope to stock all the suitable waters in the State. It may be well to state that the great object at first is to get the desirable fish here and acclimated in our waters; after that they may be bred artificially and distributed to any extent.

It is probable, or at least possible, that ten thousand Shad may return to our waters this coming Spring and forty thousand more in 1876. If such should be the case and they are properly protected by legislation, it will be no difficult or costly matter to breed from them a million of young fish, which in three years more will stock the entire coast and give us Shad as plenty as we have Smelts. But to arrive at this we require some stronger legislation which will absolutely prevent the taking for food of the new Shad as they come in; we require them all for breeding.

If it shall be the pleasure of the Legislature to continue to aid this commission, it is our intention this next coming year to renew our

effort to bring across the continent the food fishes of the east, and with the experience which we have had and the additional knowledge we have gained, we have hopes of not only repairing our loss of last year but largely to improve upon that effort. We regret to say that our loss was large. We had embarked in it all the remaining funds of the commission, but no human foresight could have predicted it or guarded against it, and we can only say that it is worth all that it has cost to know the fact that an aquarium of living fish, eels and lobsters, provided with both fresh and salt water, can be brought from the Atlantic to within one day's travel of the Pacific, in good order and in healthy condition.

Since our last report the Commissioners have given somewhat of their attention to placing in some of the streams and lakes different kinds of native and other fish, although they have not been able to do so much as they would desire to do were the means at their command. There is no cheap way of doing this work; everything pertaining to it requires dispatch and care. We are handling a delicate and perishable material, under circumstances in which the painstaking and expense of the most careful preparations may, in a moment of neglect or accident, be lost entirely. Consequently, we have refrained from any expensive experiments, and confined ourselves to the introduction of food fishes fully known to be profitable in other States, and the dissemination of such domestic fish as can be easily and cheaply transferred from one part of the State to another. In this way we have, during the past season, placed some ten thousand Lake Tahoe trout in the South Yuba River; Trout from the mountain lakes have been placed in the north fork of the American River; we have purchased from the breeders of Tahoe Trout, also, six thousand Trout, which have been placed in Lake Merced. We have also purchased two thousand Eastern Red Speckled Trout—*Salmo fontanalis*—which we placed in the north fork of the American River, near the summit. Two thousand of the same and six thousand Tahoe Trout we have placed in the headwaters of Alameda Creek, and two thousand more Eastern Speckled Trout in San Andreas Reservoir, near this city.

The Commission feels greatly encouraged in its efforts to preserve and increase the fish of California by the general interest taken by the people in this very interesting subject. On all occasions we have had the most ready aid, and in many cases gratuitous services from those with whom the operations of the Commissioners have brought them in contact, and we would respectfully suggest that we believe that the people are now willing to incur a moderate expenditure in order to have this work continued. This Commission does not believe that any large appropriation for this purpose is now necessary. Time is required to develop and perfect the successful propagation and preservation of foreign varieties of fish. We have yet a great deal to learn in regard to this subject, and undue haste and lavish expenditure are by no means the most certain way to success. It is now three years since the first attempt to bring shad across the continent was commenced. We now know that some of the shad brought here in 1871 have lived and grown to good size. The shoal of shad are not due in the rivers of California until June, 1874, but we have had in our hands three specimens, which are, of course, exceptional, and we have heard

of two others. The incoming fish will be breeders, and we shall require funds to enable us to establish breeding stations on the Sacramento and San Joaquin rivers, and, above all, we require proper laws to preserve this season's arrivals. It will be seen by the accompanying statement that the entire expenditure of the Commission since its last report, has been less than six thousand dollars, and during the existence of the Commission—four years—but seven thousand. With this a great deal has been done, and the foundation laid for the accomplishment of much more.

The work is but commenced, and as we have before remarked time in this business is a more important element than money. The most in importance is the means for preventing the destruction of the fish we already have. The Commission find it almost impossible to prevail upon the people to refrain from destroying fish in the localities where they abound. It seems as if human invention is taxed to its utmost in the desire for wholesale destruction, and the reluctance which men feel to complain of their neighbors, renders it almost impossible to enforce the laws in such cases. If the Legislature should see fit to make an appropriation sufficient to allow the Commissioners to employ, at times, a proper person to look after such violations of the fish laws and see to their enforcement, we think this evil could readily be suppressed, as the people at large show a great interest in having the law enforced, but no one is willing to make himself obnoxious by being an informer. All this would be cured by placing the means of remedy in the hands of the Commission.

The Commission already have the power to do this, and have done it with most hopeful results, so far as their limited means have allowed. It will be necessary, during this session of the Legislature, to have passed a full and comprehensive law relating to all kinds of fishing. In the first place, the whole system of fish-traps, seins, fykes, etc., should be abolished by law. Secondly the meshes of the nets used should be regulated by law. The time of fishing for salmon should be properly limited. There come from all parts of the State constant complaints of the destruction of fish by saw-dust, and refuse from saw-mills thrown into the streams; and petitions for the enactment of laws to prevent it are now before the Legislature. This Commission will be aided by many citizens interested in these matters, in passing a law covering the piscatory interests of the State, which we hope will be favorably acted upon by the Legislature. The Commissioners have taken pains to ascertain the season of the year during which the taking of salmon should be prohibited by law. We have caused careful observations to be made of the time at which the salmon ascend to the heads of the rivers to spawn, and from all the information we have been able to obtain in that way, and by consulting with persons well qualified to afford advice from the results of practical knowledge of the subject, we would recommend that the taking of salmon be prohibited by law from the first of August to the first of November. It should be observed that the having in possession, or offering for sale, of salmon during the close term so prohibited, should be punished the same as of the taking of them.

In conclusion, your Commissioners, with much diffidence, would ask the aid of the Legislature for the means of carrying on the work

which they feel they have just commenced. There will be necessary for the coming season funds to erect hatching-houses at such stations as shall have been discovered as the spawning-grounds of the Shad, now soon to be expected in our waters. The renewal of our effort to bring the fish and lobsters across the continents, so nearly successful last year, is an earnest wish of the commission. Our work at large remains unfinished at the time that we are best qualified to prosecute it. The amount of appropriation necessary to carry the commission over to the next session of the Legislature is not large, and, when we consider the object to be attained, we feel that we may safely ask for a moderate sum without laying a very heavy additional burden upon the people. The money already expended is but a trifle compared with the benefits to be derived from a like expenditure in the immediate future.

When we entered upon the duties of our office the whole subject of fish-breeding had but lately been entertained on this coast. The ground was new, and the field of operations opened to the commission covered a large extent of country and marked varieties of climate. We have been compelled to educate ourselves to the work in hand, and to move as cautiously and as economically as possible. We are willing to admit that we take great interest in the continuance of our operations; we know that we have learned a great deal about fish culture that will be useful to the State. We believe that we are now on the road to success. We are willing to give our time to it, and perhaps it is not amiss for us to make this report the means of saying that, which may not be generally known, our services are without charge of any kind to the State. We have no individual interests to subserve, and we only ask aid from the State in order that we may serve her, and carry out to completion the objects for which this commission was created.

EXPENDITURES

At the last session of the Legislature an appropriation of two thousand dollars was made to aid the commissioners in prosecuting their work, and, since our last biennial report, we have expended the following amounts:

1871		
Jan. 25.	Paid for advertising in "Union"	$22 75
Jan. 27.	Paid copying Report	59 50
Jan. 27.	Paid Comer & Co. for Tahoe Trout For South Yuba	300 00
Mar. 17.	Paid telegraph	50
Apr. 19.	Paid expenses of establishing hatching station at Clear Lake, expense of hatching White Fish eggs, and examination of Clear Lake, Blue Lake, and other waters	547 26
May 3.	Paid Acclimatization Society for Speckled Trout placed in San Andreas Reservoir	100 00
May 5.	Paid Acclimatization Society for Speckled Trout placed in the tributaries of Alameda Creek	100 00
May 10.	Paid reward for the first Shad taken	50 00
June 3.	Paid traveling expenses of Commissioners	44 00
June 3	Paid traveling expenses of R. H. Elam as Fish Warden, to Santa Cruz	60 00
June 3.	Paid Haight and Temple for legal services	50 00
June 3.	Paid Bugby for drawing for fish ladders	30 00
June 3.	Paid Cleveland for fitting up breeding troughs	77 28
June 3.	Paid T. H. Selby & Co. for lead pipe	38 09
June 12.	Paid Expenses of defending Salmon Laws	48 25
June 12.	Paid Acclimatization Society for Trout placed in American River	120 00
July 2.	Paid expenses of Commissioner to Sacramento to meet Shad	8 75
July 10.	Paid Comer and Frazer for Tahoe Trout placed in Lake Merced, 6000 in number	120 00
July 14.	Paid J. G. Woodbury for services, enforcing the Salmon Laws	104 50
July 14.	Paid Acclimatization Society for 6000 Tahoe Trout placed in Alameda Creek	120 00
July 14.	Paid expenses of placing the same	51 50
July 14.	Paid total expense of the Aquarium Car bringing fish, eels, and lobsters from the Atlantic Coast to California	*3,912 18
	Total amount expended	$5,845 56

* A part of this amount will be restored by a settlement now pending with the railroad companies.

RECAPITULATION

Amount of appropriation of 1870	$5,000.00
Amount of appropriation of 1872	2.000.00
Total	$7,000.00
Expenditures as per report of 1870 and 1871	$1.137.22
Expenditures as per report of 1872 and 1873	5,845.56
Cash remaining on hand Dec. 31, 1873	17.22
	$7,000.00

All of which is respectfully submitted.

S. R. Throckmorton,
B. B. Redding,
J. D. Farwell,
Commissioners.

APPENDIX

COMMISSIONERS ON FISHERIES

UNITED STATES

Prof. Spencer F. Baird.....Washington, D. C.

MAINE

E. M. Stilwell.....Bangor
Henry O. Stanley.....Dixfield

NEW HAMPSHIRE

Thomas E. Hatch.....Keene
William W. Fletcher.....Concord
W. A. Sanborn.....Wiers

VERMONT

M. C. Edmunds.....Weston
M. Goldsmith.....Rutland

MASSACHUSETTS

Theodore Lyman.....Brookline
E. A. Brackett.....Winchester
Asa French.....South Braintree

CONNECTICUT

William H. Hudson.....Hartford
Robert G. Pike.....Middleton
James A. Bill.....Lyme

RHODE ISLAND

Newton Dexter.....Providence
Alfred A. Reed, Jr.....Providence
John H. Barden.....Scituate

NEW YORK

Horatio Seymour.....Utica
Robert B. Roosevelt.....New York City
Edward M. Smith.....Rochester

NEW JERSEY

R. P. Howell.....Woodbury
J. H. Slack.....Bloomsbury

PENNSYLVANIA

H. J. Reeder.....Easton
B. L. Hewitt.....Holidaysburg
James Duffy.....Marietta

VIRGINIA

William B. Ball ..... Mid Lothian
Asa Wall ..... Winchester

ALABAMA

Charles S. G. Doster ..... Montgomery
Ro. Tyler ..... Montgomery
D. R. Hundley ..... Courtland

CALIFORNIA

B. B. Redding ..... Sacramento
S. R. Throckmorton ..... San Francisco
J. D. Farwell ..... San Francisco

MICHIGAN

Governor J. J. Bagley ..... Detroit
George H. Jerome ..... Niles
George Clark ..... Ecorse

OHIO

John Hussey ..... Loveland
John H. Klippart ..... Columbus
Dr. Elisha T. Stirling ..... Cleveland

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